

**IN THE CLAIMS:**

1     1.       (Original)     A shutter mechanism for controlling reactants in a direct oxidation  
2     fuel cell system, having at least one fuel cell including a membrane electrode assembly,  
3     comprising:

4             a moving component disposed within the fuel cell between a source of a reactant  
5     and the membrane electrode assembly and said moving component having features  
6     formed therein that correspond with features on a receiving element such that when said  
7     moving component is placed adjacent to said receiving element, the flow of said reactant  
8     is controlled.

1     2.       (Original)     The shutter mechanism as defined in claim 1 wherein said features  
2     on said moving component are protrusions, and said corresponding features on said ele-  
3     ment are openings, and said protrusions plug said openings when said moving component  
4     is placed adjacent to said receiving element.

1 | 3.       (Currently Amended) The shutter mechanism as defined in claim ~~1~~3 wherein said  
2     moving component is placed between a fuel source and an anode aspect of said fuel cell,  
3     and said receiving element is an anode current collector and when said moving compo-  
4     nent is placed adjacent to said anode current collector, fuel flow to said anode aspect is  
5     restricted.

1     4.       (Original)     A shutter mechanism for a direct oxidation fuel cell system, com-  
2     prising:

3             (A)     a fuel source;

4             (B)     a direct oxidation fuel cell, including:

5                 (i)     a protonically conductive membrane having catalyst coatings on  
6                         each of its major surfaces, being an anode aspect and a cathode as-  
7                         pect;

- 8 (ii) an anode current collector disposed generally at said anode aspect;
- 9 (iii) a cathode current collector disposed generally at said cathode as-  
10 pect;
- 11 (iv) a passive mass transport barrier disposed generally between said  
12 fuel source and said anode aspect and spaced from said anode as-  
13 pect to define a vapor gap in said fuel cell, said passive mass trans-  
14 port barrier controlling a rate of fuel delivery to said catalyzed an-  
15 ode aspect of said fuel cell;
- 16 (v) a movable shutter plate disposed within said vapor gap between  
17 said passive mass transport barrier and said anode current collector  
18 such that said movable shutter plate is adjustable to substantially or  
19 partially prevent fuel flow through said anode current collector to  
20 the anode aspect of said fuel cell; and
- 21 (vi) a load coupled between said anode current collector and said cath-  
22 ode current collector for utilizing the electricity generated by the  
23 fuel cell.

1 5. (Original) The shutter mechanism as defined in claim 4 further comprising:  
2 said movable plate having a plurality of protrusions disposed thereon that corre-  
3 spond with openings in said anode current collector, such that when said movable plate is  
4 adjusted to a closed position, said protrusions interconnect with the openings in the anode  
5 current collector to substantially seal said openings, and said movable plate also having  
6 apertures therein interspersed with said protrusions in such a manner that when said mov-  
7 able plate is in an open position, said apertures allow for flow of fuel therethrough; and  
8 said movable plate is adjustable in a direction perpendicular to the plane in which  
9 the plate is disposed, such that when it is adjusted, the plate travels generally in a z-axis  
10 within said vapor gap, closer to or further away from said anode current collector, to con-  
11 trol fuel flow while not consuming substantially additional volume within said fuel cell.

1 6. (Original) The shutter mechanism as defined in claim 5 further comprising:

2           said protrusions have angled sides; and  
3           said openings in said anode current collector being correspondingly angled such  
4 that said protrusions interconnect securely within said angled openings of said current  
5 collector to substantially seal said openings against fuel flow.

1   7.       (Original)     The shutter mechanism as defined in claim 5 wherein said protru-  
2 sions are substantially comprised of a compliant material that is compressed into said  
3 openings when said movable plate is adjusted to a closed position.

1   8.       (Original)     The shutter mechanism as defined in claim 5 further comprising a  
2 coating disposed on the sides of said protrusions in said movable plate which further se-  
3 cures sealing of said anode current collector against fuel flow therethrough.

1   9.       (Withdrawn)   A shutter mechanism for a direct oxidation fuel cell system, com-  
2 prising:  
3           (A)     a fuel source;  
4           (B)     a direct oxidation fuel cell, including:  
5                   (i)     a protonically conductive membrane having catalyst coatings on  
6                           each of its major surfaces, being an anode aspect and a cathode as-  
7                           pect;  
8                   (ii)    an anode current collector disposed generally at said anode aspect,  
9                           said anode current collector having a plurality of openings therein  
10                          allowing for a flow of substances into and out of said fuel cell;  
11                   (iii)   a cathode current collector disposed generally at said cathode as-  
12                          pect;  
13                   (iv)   a movable plate having openings that correspond with openings in  
14                           said anode current collector and said movable plate being adjust-  
15                          able in a lateral direction that is generally parallel to the plane in  
16                          which the plate is disposed, such that when the plate is adjusted,  
17                          the openings in said plate are aligned with the openings in said an-

18                   ode current collector providing apertures for fuel flow, and when  
19                   said plate is adjusted in an opposite direction, said openings are not  
20                   aligned such that fuel flow is controlled or substantially prevented  
21                   from entering said fuel cell; and  
22               (v)    a load coupled between said anode current collector and said cath-  
23                   ode current collector for utilizing the electricity generated by said  
24                   fuel cell.

1    10.    (Withdrawn) A shutter mechanism for a direct oxidation fuel cell system, com-  
2    prising:  
3           (A)    a fuel source;  
4           (B)    a direct oxidation fuel cell, including:  
5               (i)    a protonically conductive membrane having catalyst coatings on  
6                   each of its major surfaces, being an anode aspect and a cathode as-  
7                   pect;  
8               (ii)   an anode current collector disposed generally at said anode aspect;  
9               (iii)  a cathode current collector disposed generally at said cathode as-  
10               pect;  
11              (iv)  a movable shutter plate disposed adjacent to said cathode current  
12                   collector such that said movable shutter plate is adjustable to sub-  
13                   stantially or partially prevent oxygen flow through said cathode  
14                   current collector to the cathode aspect of said fuel cell, and to sub-  
15                   stantially or partially prevent water vapor from being released from  
16                   said fuel cell; and  
17              (v)    a load coupled across said anode current collector and said cathode  
18                   current collector for utilizing the electricity generated by said fuel  
19                   cell.

1    11.    (Withdrawn) The shutter mechanism as defined in claim 10 further comprising:

2           said movable plate having a plurality of protrusions disposed thereon that  
3           correspond with openings in said cathode current collector, such that when said  
4           movable plate is adjusted to a closed position, said protrusions interconnect with  
5           the openings in the cathode current collector to substantially seal said openings,  
6           and said movable plate also having apertures therein interspersed with said pro-  
7           trusions in such a manner that when said movable plate is in an open position,  
8           said apertures allow for flow of oxygen therethrough.

1   12.   (Withdrawn) The shutter mechanism as defined in claim 11 further comprising:  
2           said protrusions have angled sides; and  
3           said openings in said cathode current collector being correspondingly an-  
4           gled such that said protrusions interconnect securely within said angled openings  
5           of said current collector to substantially seal said openings against escape of water  
6           vapor.

1   13.   (Withdrawn) The shutter mechanism as defined in claim 11 wherein said protru-  
2           sions are substantially comprised of a compliant material that is compressed into said  
3           openings when said movable plate is adjusted to a closed position.

1   14.   (Withdrawn) The shutter mechanism as defined in claim 11 further comprising a  
2           coating disposed on the sides of said protrusions in said movable plate which further se-  
3           cures sealing of said cathode current collector.

1   15.   (Withdrawn) A shutter mechanism for a direct oxidation fuel cell system, com-  
2           prising:

- 3           (A)   a direct oxidation fuel cell, including:
- 4                   (i)   a protonically conductive membrane having catalyst coatings on  
5                       each of its major surfaces, being an anode aspect and a cathode as-  
6                       pect;
- 7                   (ii)   an anode current collector disposed generally at said anode aspect;

- 8 (iii) a cathode current collector disposed generally at said cathode as-  
9 pect, said cathode current collector having a plurality of openings  
10 therein allowing for flow of substances into and out of said fuel  
11 cell;
- 12 (iv) a movable plate having openings that correspond with openings in  
13 said cathode current collector and said movable plate being adjust-  
14 able in a lateral direction that is generally parallel to the plane in  
15 which the plate is disposed, such that when the plate is adjusted,  
16 the openings in said plate are aligned with the openings in said  
17 cathode current collector providing apertures for oxygen flow, and  
18 when said plate is adjusted in an opposite direction, said openings  
19 are not aligned such that oxygen flow is controlled, and water va-  
20 por is substantially prevented from exiting said fuel cell; and
- 21 (v) a load coupled between said anode current collector and said cath-  
22 ode current collector for utilizing the electricity generated by said  
23 fuel cell.

- 1 16. (Withdrawn) A method of transferring heat in a direct oxidation fuel cell system,  
2 including the steps of:
- 3 (A) providing a movable plate, said movable plate having a plurality of protru-  
4 sions disposed thereon that correspond with openings in a current collector  
5 of an associated direct oxidation fuel cell;
- 6 (B) adjusting said movable plate to a closed position in which said protrusions  
7 interconnect with the openings in the current collector to substantially col-  
8 lect heat from said current collector; and
- 9 (C) transferring heat from said current collector to another portion of the fuel  
10 cell system, or dissipating heat out of said fuel cell system via said mov-  
11 able plate.

- 1    17.    (Withdrawn) The method of transferring heat in a direct oxidation fuel cell system  
2    as defined in claim 16 including the further step of:  
3            adjusting said movable plate in a direction perpendicular to the plane in which the  
4    plate is disposed, such that when it is adjusted, the plate travels generally in a z-axis, and  
5    comes in contact with said current collector to collect heat.